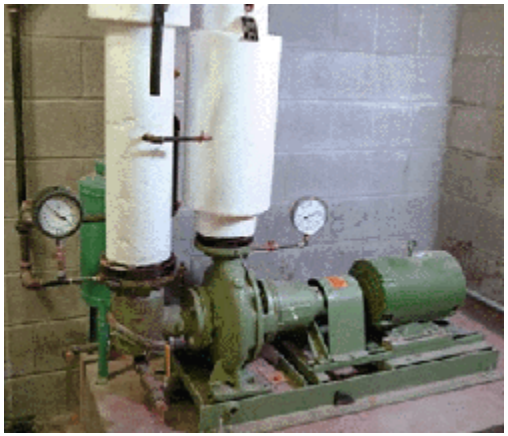
Geothermal Heat Pumps

Geothermal Heat Pump Overview

The geothermal heat pump, also known as the ground source heat pump, is a highly efficient renewable energy technology that is gaining wide acceptance for both residential and commercial buildings. Geothermal heat pumps are used for space heating and cooling, as well as water heating. Its great advantage is that it works by concentrating naturally existing heat, rather than by producing heat through combustion of fossil fuels.



Geothermal heat pumps, such as this commercial-size system on the Georgia Tech campus, use the relatively constant temperature of the Earth at shallow depths to warm buildings in the winter and cool them in the summer. *Craig Miller, U.S. Department of Energy. (PIX 02211)*

The technology relies on the fact that the Earth (beneath the surface) remains at a relatively constant temperature throughout the year, warmer than the air above it during the winter and cooler in the summer, very much like a cave. The geothermal heat pump takes advantage of this by transferring heat stored in the Earth or in ground water into a building during the winter, and transferring it out of the building and back into the ground during the summer. The ground, in other words, acts as a heat source in winter and a heat sink in summer.

The system includes three principal components:
- Geothermal earth connection subsystem
- Geothermal heat pump subsystem
- Geothermal heat distribution subsystem.

Earth Connection
Using the Earth as a heat source/sink, a series of pipes, commonly called a "loop," is buried in the ground near the building to be conditioned. The loop can be buried either vertically or horizontally. It circulates a fluid (water, or a mixture of water and antifreeze) that absorbs heat from, or relinquishes heat to, the surrounding soil, depending on whether the ambient air is colder or warmer than the soil.

Heat Pump
For heating, a geothermal heat pump removes the heat from the fluid in the Earth connection, concentrates it, and then transfers it to the building. For cooling, the process is reversed.

Heat Distribution
Conventional ductwork is generally used to distribute heated or cooled air from the geothermal heat pump throughout the building.

Residential Hot Water
In addition to space conditioning, geothermal heat pumps can be used to provide domestic hot water when the system is operating. Many residential systems are now equipped with desuperheaters that transfer excess heat from the geothermal heat pump's compressor to the house's hot water tank. A desuperheater provides no hot water during the spring and fall when the geothermal heat pump system is not operating; however, because the geothermal heat pump is so much more efficient than other means of water heating, manufacturers are beginning to offer "full demand" systems that use a separate heat exchanger to meet all of a household's hot water needs. These units cost-effectively provide hot water as quickly as any competing system.

For more information contact the Geothermal Heat Pump Consortium